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EDITORIAL

There have been notable efforts recently on the part of a number of individual enthusiasts to start the development of the poultry industry in the Philippines. These activities are commendable, indeed, in view of the fact that in the chicken, as well as other poultry and their products, we see some solution to the problem of food supply with which the Philippines finds itself seriously confronted from time to time. There are very few industries which require so small an initial outlay of capital as poultry raising and which bring bigger comparative returns for the capital involved. The labor necessary for the adequate maintenance of the poultry yard and the proper care of the flocks is also not very much. There are many localities in the Philippines, the natural conditions of which are such as to make them peculiarly suited to poultry culture. Feeds are abundant, cheap, and easily procurable at practically all seasons of the year. There are no extremes of temperature which would require more complicated methods of manipulation, as usually occurs in temperate countries. There are very few serious pests and diseases to contend with, and, provided the pens are constantly kept in sanitary condition, very little trouble from these sources is likely to arise.

We would like to see more care exercised in the selection of stock used for breeding purposes. We should abandon the old practice of marketing the best looking birds of the flock for the higher prices which they would bring or caging the finest roosters for training as game cocks, leaving the inferior males to mate with the hens. This practice, which is unfortunately a very general one in the Islands, is largely responsible for the

deterioration of our poultry races. We would like to see more of the improved breeds which have been pronounced to be better suited to the conditions of this country and more productive of returns kept in preference to inferior native stocks. We have particularly in mind the Barred Plymouth Rock and the Cantonese chickens, which have been proved, by experiments conducted both in this College and in the Bureau of Agriculture, to surpass by far the native chickens both in egg-laying and in meat production. We would also like to see the poultry business more generally established as an independent industry in the Philippines and more scientific and adequate treatment accorded to the fowls wherever they are kept. It is our belief that chicken raising here should be confined to a few birds in the home yard, rather than large flocks, which under ordinary conditions are rather difficult to give proper care. If every family in the Philippines will but keep a few chickens, it will have provided itself with an interesting avocation, as well as a means of utilizing kitchen refuse which would otherwise go to waste, and the aggregate effects of this practice would, we are sure, become manifest in a very considerable addition to the country's food supply.

A Study of the Effects of Animal and Plant Proteins in Rations for Laying Hens*

By Francisco M. Fronda

INTRODUCTION

The hen can be considered as a living machine which can convert raw materials into a palatable and highly nutritious finished product—the egg. In order to be able to do this, the hen must have, aside from the nutrients necessary to maintain her body, some extra materials from which the egg may be produced.

In the Philippines, most families keep a small flock of chickens which are very often poorly fed, and consequently, produce only few eggs. The families use these eggs in a number of ways. Some are used in the home, some are sold for cash, and some are bartered at the country stores for goods. As the eggs have such a variety of uses, to produce a greater number from the flock would surely be an economic advantage.

"The method of feeding, as well as the nature of the feeds given, largely control the maximum egg production of laying hens." (1) The results of experiments carried on along this line, seem to show that an addition of animal-protein feed to the ration helps to increase the egg production of laying hens. The results of a four-year experiment performed at the Indiana Station by Philips (2) show that the average egg production per hen per year of fowls fed with a ration containing meat food was 132.8 eggs, while those which did not receive any meat food averaged only 32.5 eggs.

The value of plant proteins in rations for laying hens has been investigated by various experiment stations in the United States. The conclusions arrived at through these investigations seem contradictory. Morrison (3) and Clayton (4), both of the Mississippi Experiment Station, recommend the use of cottonseed meal in a mash for laying hens. Ahrens (5), of the Oklahoma Station, working with cottonseed meal found that "as a feed for egg production..... beef scrap is superior to cottonseed meal and more than makes up the geater cost by apparently causing greater egg production." Kempster, (6) of the Missouri Station, reports the following results in egg production per hen per year from using various protein supplements for laying hens:

Supplement	*Number of Eggs*
Beef scrap	120.3
Sour milk	129.0
Oil meal	64.9
Gluten meal	63.8
Cottonseed meal	66.0
No basal protein	57.3

From these results, it appears that the addition of plant proteins to the rations for laying hens did not have any marked effect on the egg production, while animal proteins practically doubled it.

Just how animal and plant proteins will affect the fertility and hatchability of the eggs and the vitality of the chicks is also a question of economic importance. Aherns (5) reported that with regard to fertility and hatchability of eggs, cottonseed meal was superior to beef scrap, but as to the vitality of the chicks, he said that "mortality was a great deal higher in hens fed cottonseed meal."

Beef scrap, milk, oil meal, gluten meal, and cottonseed meal, were the feeds used in the above tests. These materials are not readily obtainable in the Philippines. It is therefore necessary

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* Thesis presented for graduation from the College of Agriculture No. 77; Experiment Station Contribution No. 6.

that similar tests be made to suit Philippine conditions. The aim of the present work is to find out the effects of animal and plant proteins upon the egg production, fertility and vitality of poultry. The animal protein was supplied in the form of snails and the plant protein in the form of copra meal.

This experiment was conducted at the College of Agriculture, and it covered a period of one year, from March 15, 1918, to March 15, 1919.

MATERIALS USED

The stock used consisted of twenty-four native laying hens and two pure-bred Cantonese roosters. Eighteen of the hens were from José Mariano's experimental pens of 1917-1918(7) and the remaining six were pullets about one year old from the College flock. The fowls were all healthy and vigorous. They were divided into lots of twelve hens each. The fowls of each lot were numbered from 1 to 12, inclusive. Care was exercised in making the division to secure as far as practicable for each lot uniformity in size, health, vigor, and other favorable external indications in the individual birds. The pens were designated as Lot A and Lot B. Each pen had one rooster, and to render the influence of the male on the fertility of the eggs uniform, they were changed from one pen to the other once a week.

The weights of the hens at the beginning and at the end of the experiment were taken, and carefully recorded:

TABLE I

WEIGHTS OF THE HENS IN GRAMS

Lot A (Fed with Copra Meal)				*Lot B (Fed with Snails)*			
Hen Number	*March 14, 1918 Weight*	*March 14, 1919 Weight*	*Gain or Loss*	*Hen Number*	*March 14, 1918 Weight*	*March 14, 1919 Weight*	*Gain or Loss*
A 1.....	1250	1310	+ 60	B 1	1420	1580	+160
A 2.....	880	910	+ 30	B 2	950	963	+ 13
A 3.....	1120	1320	+200	B 3	1270	1545	+275
A 4.....	1120	1634	+514	B 4	1200	1090	—110
A 5.....	1030	1320	+290	B 5	1015	1035	+ 20
A 6.....	1685	1511	—174	B 6	995	1208	+213
A 7.....	1332	1130	—202	B 7	1340	1300	— 40
A 8.....	1150	1062	— 88	B 8	1130	1080	— 50
A 9.....	1285	Dead		B 9	1230	1600	+370
A10.....	1160	1170	+ 10	B10	1100	1214	+114
A11.....	1300	Dead		B11	1615	1910	+295
A12.....	1350	1350	0	B12	1500	1770	+270
Total...	14742	12717	+330	Total	14765	16295	1530
Average Weight....	1246.7	1271.7	+ 33	Average Weight	1230.4	1357.9	127.5

NOTE:—The first three hens in each lot (Hens 1, 2 and 3) were pullets. These hens were from the College flock. The others, Hens 4, 5, 6, 7, 8, 9, 10, 11, and 12, were in their second laying year and were from José Mariano's experimental pens of 1917-1918.

Table I gives the weights of the hens at the beginning and at the end of the experiment. It shows that six hens of Lot A (plant-protein fed) gained a total of 794 grams and four lost 464 grams, with a net gain of 330 grams; nine hens of the animal-protein fed pen gained 1730 grams and three hens lost 200 grams with a net gain of 1530 grams.

Morrison(3), working with cottonseed meal concluded that the tendency of the fowls fed with cottonseed meal "was to lose flesh and not get overfat, although the fowls were allowed access to the

feeds at all times." This experiment seems to show that copra meal, if fed to chickens, has the same effect as cotton-seed meal.

HOUSING AND YARDING

Each lot occupied one-half of a gable-roofed type house, which was 3 by 2.5 meters, or in other words, about 1.5 by 2.5 meters of floor space, thus allowing about 0.28 square meters to each chicken. The house was made of bamboo and nipa and was more or less open in construction. The walls, which were made of woven bamboo were about two meters high. Roosts were provided and a dropping board made of pieces of boards taken from kerosene boxes and nailed together as closely as possible was placed below each of these roosts Each lot was equipped with three trap nests, with excelsior as nesting material, and placed beneath the dropping board.

Each lot was allowed a grass range of about 12.5 by 17 meters. Each range was divided into two parts to which the fowls had access during the wet months of the year. During dry season, the lots were alternated so as to have a constant supply of green feed.

DROPPINGS

Poultry manure has very high fertilizing value. Although it is a very valuable fertilizer, it is often thrown away by many poultry raisers. They should get not only returns in eggs or meat from their fowls, but also use should be made as much as possible of their manure.

In this experiment care was taken in the collection of the daily manure, to determine just how much a native hen produced at night in a year. Philips (2), in his experiments in poultry, found that "leghorn pullets produced about twenty-one pounds of manure at night a year."

To keep a record of the droppings, the dropping boards were cleaned once a day at first, but the amount was so small that collection was made only once a week afterwards. The droppings collected were put in open cans provided for each lot. At the end of each month, these droppings were weighed and the weights recorded. These weights, of course, were more or less influenced by weather conditions, as nothing was devised to prevent the escape of moisture from the droppings.

TABLE II

WEIGHTS OF MANURE

(Weights are given in kilograms.)

Date weighed	*Lot A Copra meal-fed*	*Lot B Snail-fed*	*Average*
	1 rooster 12 hens	*1 rooster 12 hens*	
March 31, 1918 (*a*)	1.06	1.01	1.035
April 30	2.04	2.11	2.075
May 31	2.11	1.95	2.03
June 30	2.41	2.00	2.205
July 31	2.58	2.35	2.465
August 31	2.7	2.7	2.7
September 30	2.6	2.7	2.65
October 31	2.6	2.4	2.5
November 30	2.6	2.5	2.55
December 31	2.6	2.5	2.55
January 31, 1919	2.1	2.5	2.3
February 28	1.8	2.4	2.1
March 15 (*b*)	1.2	1.6	1.4
Total	28.40	28.72	28.56
Average per bird (approximate)	2.184	2.209	2.197

(*a*) Experiment was begun March 15, 1918.
(*b*) Experiment ended March 14, 1919.

The above table shows that about 2.2 kilograms of manure were produced at night by the native hens used in this experiment per month. This big difference from the results of Philips is due largely to the fact that weighing in the present case was done only once a month, the manure having already lost most of its moisture.

As far as the different lots were concerned, there was not any appreciable difference between the amounts of manure produced at night by the plant-protein-fed pen and the animal-protein-fed pen. This is shown in Table II,

where the average amount of manure produced per bird is 2.184 and 2.209 kilograms, respectively, the average for both being 2.197 kilograms.

FEEDING

Feeds used.—Both lots were fed with a basal ration of grain and mash. The grain mixture consisted of a combination of equal parts of whole grains of rice and corn. The mash mixture consisted of equal parts of ground corn, ground rice, and rice bran, thoroughly mixed together. At all times the fowls had access to succulents in the form of green grass. Ripe papaya fruits were given occasionally in the beginning of the experiment. The fowls had access to ground charcoal, grit, and oyster shell at all times. In addition to these basal rations, Lot A received copra meal, and Lot B received ground and boiled snails. The copra meal was mixed with the same quantity of rice bran and placed in an open container to which the fowls had access at all times. The snails were given daily during a period of thirty days except when, due to unfavorable weather conditions, snails could not be collected.

Manner of feeding.—Great care was taken in the way the chickens were fed, as many authorities on poultry claim that the amount of egg production depends not only upon the kind of feed given the fowls but also upon the manner in which it is given. In the morning only about half of the amount that the fowls could consume was furnished them. In the afternoon, they were given as much feed as they were able to eat. A few grains were left on the ground for the fowls to pick up early the next morning when they were just from the roosts.

There are reasons for this method. The fowls were only half fed in the morning to induce them to spend the rest of the day walking around looking for more feed, and thus getting ample exercise. If fully fed, they would remain quiet during the rest of the day, and hence they would have a tendency to fatten, which condition is not desirable in laying hens.

The mash mixture was fed in self-feeding troughs which were kept open all the time during the progress of the experiment. At first the tendency of the fowls was to overfeed themselves with the mash. Later, however, when they learned that they could get the feed when they wanted it at their leisure, they took just a little of it at a time. Hence, the meals after a time were more or less regulated.

Many poultry keepers practice feeding the mash in wet condition. They do this to induce the birds to take more of the feed. This is not recommended, as wetting the mash makes it sour quickly, and sour feed may cause digestive troubles.

Amount of feed consumed.—Separate containers for the grain and mash mixtures were kept in each lot. The grain and mash mixtures were weighed at the beginning of the week, before putting them in these containers and at the end of the week, the portions left unconsumed were reweighed, so that the amount of feed eaten could be recorded.

Ground charcoal, grit, and oyster shell, the weights of which were recorded, were kept all the time separately in the different compartments of the self-feeding troughs. The copra meal fed to Lot A was given in a self feeder. Lot B was fed about 360 grams of snails daily.

TABLE III

FEED CONSUMED DURING THE YEAR IN KILOGRAMS. (*Weights are given in kilograms.*)

Date	Lot A (Copra-Meal Fed)				Lot B (Snail-Fed)			
	No. of Birds	Mash	Grain	Copra Meal	No. of Birds	Mash	Grain	Snail
1918								
March 15 to April 4.....	13.	5.5	11.1	1.37	13	5.4	10.96	7.015
April 5 to May 3.....	13.	7.72	12.7	1.76	13	6.49	13.32	8.32
May 4 to June 6.....	13.	6.92	12.96	1.74	13	6.96	18.4	10.1
June 7 to July 5.....	13.	6.49	16.	1.54	13	6.95	15.44	8.36
July 6 to August 3....	13.	7.09	15.32	2.1	13	6.94	15.18	9.22
August 4 to September 6.	13.	8.1	23.6	1.41	13	9.29	22.6	12.142
September 7 to October 4...	13.	7.07	12.25	1.64	13	6.88	17.6	9.2
October 5 to November 1.	13.	6.18	18.7	1.62	13	6.	18.4	10. 1
November 2 to December 5 . 1919 ...	13.	8.67	19.05	2.58	13	9.09	20.	13.54
December 6 to January 3...	13. (*a*)	6.46	15.5	2.32	13	7.5	16.8	8.69
January 4 to February 1..	12.62	7.5	16.8	1.2	13	7.0	16.1	11.18
February 2 to March 1.....	12. (*b*)	7.6	17.05	2.5	13	8.2	16.92	12.68
March 2 to March 14...	11.15	1.48	6.6	.73	13	3.8	8.8	4.42
Total.....	165.77	86.78	202.63	22.51	169	90.50	210.52	124.967
Average.....	12.75	6.82	15.89	1.76	13	6.96	16.19	9.68

a. One hen died on January 22, 1919.

b. One hen died on March 4, 1919.

The amounts of the feeds consumed by the birds of both lots are given in Table III. This table shows that the birds of Lot A consumed 86.78 kilograms of mash, 202.63 kilograms of grains and 22.51 kilograms of copra meal; and Lot B consumed 90.50 kilograms of mash, 210.52 kilograms of grains, and 124.967 kilograms of snails. The average consumption of feeds during the year was practically the same in both lots, except in the case of the protein supplements, where each bird in Lot A consumed only 1.76 kilograms of copra meal, while each bird in Lot B consumed 9.62 kilograms of snails. This low consumption of copra meal is due probably to the birds finding it unpalatable.

In Jose Mariano's pens of 1917-1918, he found that the average consumption of feed per bird during the year (average of three lots) was 18.986 kilograms of grains and 3.52 kilograms of the mash which means that the mash consumed is about one-sixth of the grain. In this experiment it was found that each bird in Lot A consumed 6.82 kilograms of the mash and 15.89 kilograms of the grains or two-thirds of the grains consumed being equal to the mash, and each bird in Lot B consumed 6.96 kilograms of mash and 16.19 kilograms of grains, the mash being slightly over two-thirds of the grains.

EGG PRODUCTION

The essential feature in the successful working of a trap nest is that when a hen gets inside, she cannot get out unless released by a caretaker. Because of this feature, trap nests were provided for each lot for the purpose of keeping individual annual egg production. But some of the trap nests did not work well, and a large number of eggs collected could not be identified. These unidentified eggs were found either inside the nests without the hen or outside of the nests. Because of this the individual annual egg production cannot be given accurately. Moreover, there were hens that acquired the habit of laying their eggs outside the nests rather than inside.

TABLE IV-A

SUMMARY TABLE OF EGG PRODUCTION

LOT A

Months in 1918—1919

Number of hens	*Mar.*[a]	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Jan.*	*Feb.*	*Mar.*[d]	*Total*
A-1	0	2	1	0	9	1	3	0	0	0	0	7	1	24
A-2	0	8	3	6	1	6	6	1	0	4	2	4	3	44
A-3	0	0	3	0	2	0	0	0	6	5	1	4	0	21
A-4	2	4	1	1	2	1	0	0	0	0	0	2	1	14
A-5	0	1	1	1	0	2	0	0	0	5	2	5	0	17
A-6	5	1	2	0	0	0	0	0	0	4	4	1	0	17
A-7	7	5	0	1	6	1	2	0	1	9	0	4	0	36
A-8	4	5	1	1	3	1	0	0	0	0	0*b*	5	2	22
A-9	3	2	3	3	5	2	3	3	0	0	0	–	—	24
A-10	0	1	1	0	5	0	0	0	5	3	0	1	3	19
A-11	0	0	1	0	0	0	0	0	0	0	0	0	0*c*	1
A-12	3	4	0	0	5	1	1	0	0	1	0	0	0	15
A-X	6	24	34	6	15	12	11	5	14	13	4	16	12	172
Total	30	57	51	19	53	27	26	9	26	44	13	49	22	426
Average Egg Production	2.5[a]	4.75	4.25	1.58	4.41	2.25	2.17	0.75	2.17	3.67	1.08	4.08	1.83[d]	36.25

a. Experiment began March 15, 1918.
b. Died January 22, 1919.
c. Died March 4, 1919.
d. Experiment closed March 14, 1919.

TABLE IV-B

SUMMARY TABLE OF EGG PRODUCTION

LOT B

Months in 1918-1919

Number of hens	*Mar.*[a]	*Apr.*	*May*	*Jun.*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Jan.*	*Feb.*	*Mar.*[b]	*Total*
B-1	6	5	0	2	1	2	0	2	2	0	3	5	1	29
B-2	0	1	0	1	1	1	3	2	0	0	1	0	0	10
B-3	0	0	0	3	5	1	1	3	0	5	6	7	0	31
B-4	4	5	3	1	8	1	1	2	0	6	3	5	1	40
B-5	2	3	0	1	7	4	0	0	0	1	1	0	2	21
B-6	0	1	1	0	0	0	0	1	0	0	8	0	0	11
B-7	1	3	1	1	0	0	5	5	2	8	3	2	0	31
B-8	5	3	3	0	4	2	1	4	6	5	6	3	0	42
B-9	0	2	0	4	3	5	3	0	2	2	4	1	1	27
B-10	3	3	0	3	0	4	4	0	3	3	4	2	1	30
B-11	0	1	2	2	1	3	2	1	0	0	8	5	1	26
B-12	3	3	2	0	2	0	0	0	0	1	5	7	1	23
B-X	6	35	39	15	21	23	10	34	24	17	32	35	33	324
Total	30	65	51	33	53	46	30	54	39	48	84	72	40	645
Average Egg Production	2.5[a]	5.42	4.25	2.75	44.1	3.83	2·5	4.5	3.25	4	7.0	6.0	3.33[b]	53.75

a. Experiment began March 15, 1918.
b. Experiment closed March 14, 1919.

At first the nests were visited every two hours but it was observed that the laying was done in the afternoon between one and six o'clock; so the eggs were gathered some time between two and six o'clock in the afternoon. Each egg was numbered according to the number of the hen that laid it, and the unidentified ones were marked X, and added to the total egg production of the lot. To minimize errors in recording the eggs, they were recorded as soon as collected, in blank sheets furnished each lot, and again recorded in permanent records on reaching the laboratory. These two tables were compared at the end of every month.

Table IV* gives the record of the individual egg production during the year. This table is summarized in Tables IV-A and IV-B where the total number of eggs produced are given. By reference to Table IV-A, it can be seen that the total number of eggs produced by Lot A is 426,172, 40.33 per cent of which are unidentified. Table IV-B gives the total number of eggs produced by Lot B. It shows that this lot produced 624 eggs, 324 or 50.23 per cent of which are unidentified. Although there were high percentages of unidentified eggs in both lots, yet there were two hens in Lot A that produced 36 and 44 identified eggs respectively during the year and in Lot B five hens produced from 30 to 42 identified eggs each. The rest of the hens in both lots produced from ten to thirty eggs each during the year, with the exception of hen A-11 which laid only one identified egg. The average egg production per bird including the identified eggs, was 36.25 for Lot A and 53.75 eggs for Lot B, representing a difference of 17.50 eggs in favor of the pen fed with snails. It can therefore be safely concluded that snail-fed chickens will produce a greater number of eggs than copra-meal-fed chickens.

Incidentally, the average egg production per bird per year of Mariano's flocks and the present results may be compared. Mariano had three lots, one of which had no rooster, the second had one and the third, two. His results show that there was not any material difference in the egg production of the three different lots. His birds received practically the same feed as the chickens in the present experiment, except that one-sixth of his mash ration consisted of copra meal. In addition to this, thirty-five grams of ground snails were given every day to each lot. He obtained an average egg production of 36.48 eggs per bird per year. This result compared with the results obtained in the present work shows that when hens are fed with small amounts of copra meal and snails, egg production is the same as if copra meal alone is fed, but if snails are exclusively fed in a greater amount as source of protein, the egg production will be greatly increased.

TABLE V

DISTRIBUTION OF EGG PRODUCTION BY MONTHS

The first figures given are from Jose Mariano's thesis and are averages of three pens (1917-1918); the last two are averages of monthly egg production of Lots A and B

Months	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sep.*	*Oct.*	*Nov.*	*Dec.*	*Jan.*	*Feb.*	*March*
Mariano's results with 30 hens; average for 1 hen..	1.90	4.289	5.78	4.30	2.45	2.2	2.18	1.01	1.80	1.06	1.88	5.67	
Lot A (copra-meal fed) 12 hens, average for 1 hen..	2.5[a]	4.75	4.25	1.58	4.41	2.25	2.17	0.75	2.17	3.67	1.08	4.08	1.83 [b]
Lot B (snail fed) 12 hens; average for 1 hen.....	2.5[a]	5.42	4.25	2.75	4.41	3.83	2.5	4.5	3.25	4.	7.	6.	3.33 [b]

(*a*) From March 15. (*b*) Till March 14.

* Suppressed in this issue.

A comparison of the individual egg production by months of Mariano's chickens (1917-1918) and the present results is given in Table V. Mariano's results show that the greatest egg production per bird per month occurred in February, March, April, May and June. In this experiment, the results seem to follow the same course, although it is not very noticeable in Lot B (snail-fed). This shows that if hens are supplied with snails, the egg production is only slightly lower during the time they are molting than when they are not molting.

RELATIVE COST OF EGG PRODUCTION

By reference to Tables III and IV, we find the amount of feeds and the total number of eggs produced by each lot, respectively. In the computation of the cost of feeds, grit, charcoal, oyster shell, and papayas are not included, as the amount consumed was very little.

The prices of feeds used in this computation, per kilogram, are as follows:

Rice.....	₱0.116	Rice bran...	₱0.008
Corn.....	0.11	Copra Meal..	0.026
		Snails. ₱1.027	

The eggs sold at 72 centavos a dozen. These figures are the actual prices of the different articles at the time of this writing, March, 1919.

TABLE VI

RELATIVE COST OF EGG PRODUCTION

Lot	*Mash kilograms*	*Grain kilograms*	*Copra Meal kilograms*	*Snails kilograms*	*Total cost*	*No. of Eggs Produced*	*Value of Eggs at -P-0.06*	*Returns above cost of feed*
Lot A (Copra-meal fed).....	86.78	202.63	22.51			426		
Cost.....	₱8.52	₱22.90	₱.57		₱31.99		₱25.56	—₱6.43
Lot B (Snail-fed.).....	90.50	210.52		124.967		645		
Cost.....	₱9.23	₱23.79			₱36.39		₱38.70	+ ₱2.31

In Table VI the relative cost of egg production of both lots are compared. The total cost of feeds consumed by Lot A is ₱31.99 and that consumed by Lot B is ₱36.39. The eggs produced (sold at 6 centavos each) by Lot A is ₱25.56 and Lot B, ₱38.70. This means a loss of ₱6.43 in Lot A, the cheaper priced feed, and a gain of ₱2.31 in Lot B, the higher priced feed.

FERTILITY AND VITALITY TESTS OF THE EGGS. METHODS OF INCUBATION.

Natural.—At first, only natural incubation was used in this experiment, but since the supply of broody hens was limited, the use of artificial incubation was later resorted to. None of the hens in this experiment were allowed to set. For the hatching room, one of the compartments of a long house with cement floor and netted wire sidings was used. Trap nests, provided either with excelsior or rice straw were used. These were placed directly on the floor, thus reducing the danger of breaking the eggs. The room was cool and well ventilated.

Any broody hen found in the College flock was used as setter. The setting hens were allowed to come off once a day for feeding and watering. Clean, cool water and plenty of whole grain, such as corn and rice, were available. The number of eggs given to a setting hen varied from 12 to 18, 12 to 14 being given to the smaller Cantonese and

native hens, while as many as 18 were given to the bigger mestizo Black Orpington hens. With good results the Cantonese and the mestizo Black Orpington hens were found to be much superior as setters to the native hens. The native hens sometimes became wild and left the nests.

To reduce the possible danger from lice and mites infesting the chicks, flowers of sulphur were sprinkled in the nests and the hens were dusted with a louse powder of which the following is the formula:

Gasoline ..... 3 parts
Creolin ..... 1 part
Calcium sulphate ..... enough to absorb whatever moisture may be present, so that the resulting mixture is a fine, dry powder.

With this treatment, practically none of the chicks produced were infested with either lice or mites.

Artificial.—Artificial incubation was used from the latter part of November, 1918, to the end of the experiment, March, 1919. The primary object of using this method was not to produce chicks, but to determine the fertility of the eggs.

A 240-egg Queen hot-water incubator was used. It was placed in one of the corners of the College Bodega. In the operation, the directions given in the incubator book were closely followed. (8)

In the use of the incubator, the results were very unsatisfactory. Although the incubator produced chicks free from lice and mites, yet the per cent of hatch was very poor, the highest that the writer obtained being only about thirty-five per cent. In addition to the low per cent of hatch, the chicks were usually poor in vitality.

The eggs set in both cases were not more than seven days old. They were kept under approximately the same conditions. Eggs were set every seventh day continuously till the end of the experiment. Fertility tests were made on the seventh day after setting. To determine the effect of the feeds on the development of the embryo chicks, a second test of the eggs was made on the fourteenth day. As the results in using the incubator were too uncertain, the eggs were not allowed to hatch in the machine. They were transferred under a hen before hatching, usually after seven days in the machine. The low per cent of hatches obtained may be attributed to their being placed first in the incubator. Eggs from both lots were handled together to eliminate differences.

TABLE VII

FERTILITY OF EGGS

	Lot A Copra-meal fed pen	*Lot B Snail-fed pen*
Number of eggs incubated.	150	235
Number of fertile eggs	125	199
Per cent fertile eggs	83.33	84.6

Tables VII and VIII give the fertility and the hatchability of eggs, respectively. All of the eggs incubated were tested for fertility, but not all of them were allowed to hatch, so that two separate tables are presented.

In Lot A, 150 eggs were incubated, and 125, or 83.33 per cent were fertile, and in Lot B, of the 235 eggs incubated, 199, or 84.68 per cent, were fertile. The difference between the fertility of both lots is very insignificant. According to these results, therefore, copra meal had no more effect on fertility of eggs than snails.

Of the 150 eggs incubated from Lot A and 235 eggs from Lot B, 100 and 140 eggs, respectively, were allowed to hatch. These were tested for fertility and dead germs. Of the 100 allowed to hatch for Lot A, 80 per cent were fertile, of which 11.25 per cent were dead in the first test, 8.75 per cent, dead in the second test, 25 per cent did not hatch, 5 per cent pipped, and 50 per cent hatched. Of

TABLE VIII

HATCHABILITY OF EGGS

	Lot A Copra-meal-fed pen		*Lot B Snail-fed pen*	
No. of eggs incubated	100		140	
No. of fertile eggs	80		112[a]	
Per cent of fertile eggs		80		80
No. of germs dead in first test	9		4	
Per cent D_1 from fertile eggs		11.25		3.57
No. of germs dead in second test	7		16	
Per cent D from fertile eggs		8.75		14.28
No. of eggs that did not hatch	20		32	
Per cent of D from fertile eggs		25.0		28.57
No. of eggs pipped	4		6	
Per cent of P from fertile eggs		5.0		5.35
No. of eggs hatched	40		44	
Per cent hatched from fertile eggs		50.0		43.13

[a] Three eggs were lost before the second test and seven eggs were broken before hatching after the second test.

the 140 eggs which were allowed to hatch for Lot B, 80 per cent were fertile, 3.57 per cent of which were dead in the first test, 14.28 per cent dead in the second test, 28.57 per cent did not hatch, 5.35 per cent pipped and only 43.13 per cent hatched. These results show that the copra-meal-fed lot produced eggs that are more hatchable than the snail-fed lot.

BROODING

Natural brooding was used in this experiment. The hens and the chicks were kept in the long house, each hen occupying one compartment. The cement floor being cold at night, either empty petroleum packing boxes or cement barrels were provided each compartment for the hens and the chicks to stay in at night.

To provide the chicks a bigger run, additional compartments enclosed with netted wire, were made back of the long house. The chicks could get access to these runs through small doors in the back of the main compartments. With these additional runs the chicks were eventually provided with green feed.

When the chicks were three or four days old, they were allowed to go out of their compartments a certain time during the day. They, however, were not allowed outside earlier than nine o'clock in the morning, to prevent them getting chilled when the hen takes them around through wet grass. This chilling would lower their vitality, thus predisposing them to disease.

CARE AND FEEDING OF CHICKS

As a rule, "chicks should not be fed from thirty-six to forty-eight hours after hatching." (9) In this experiment, the first feed was given between thirty-six and forty-eight hours after hatching. This allows sufficient time for a complete absorption of the yolk material which is taken into the body just prior to hatching. (9) The chicks were given as equal treatment as possible.

The first feed consisted of hard boiled eggs, chopped fine, shell and all, mixed with from six to eight parts of rice bran and two or three pinches of clean sand. This feed was given for three days, the proportion of rice bran decreasing to two

parts to one of egg. In addition, on the second day of feeding, a little grain mixture, consisting of one part by weight each of crushed corn and rice, was given in the morning. From the third day on, this grain mixture was given twice a day, in the morning and in the afternoon. On the fourth day, the mash mixture was changed. Instead of supplying the protein feed from eggs alone, either copra meal or soy-bean meal was added to the mixture. The mixture consisted of the following:

Rice bran	5 parts
Soy bean meal or copra meal	1½ parts
Eggs	2 parts
Ground bone	½ part
Charcoal	a small quantity

After a week, corn and rice, finely ground, were added to the mash mixture. Because of the high cost of eggs, these were eliminated from the ration. What animal feed was needed was supplied with termites and milk given occasionally. The insects that the chicks picked here and there when they were allowed to go out also furnished a part of their animal protein food. The ration consisted then of the following:

Ground rice	5 parts
Ground corn	5 parts
Rice bran	5 parts
Soy-bean meal	3½ parts
Ground bone	1 part
Termites and milk	given occasionally.
Charcoal	accessible at all times.

The mash mixture was given a little at a time, at regular intervals, four times a day. This manner of feeding made the chicks active and they appeared hungry at every feeding time. "Overfeeding or infrequent feeding is likely to result in listlessness or dumpishness on the part of the entire flock, which should be recognized at once as a danger signal and some means of livening them up be resorted to." (9) When milk was used, it was given by wetting the mash with it.

Fresh water was provided the chicks every morning. As a safeguard from cold and catarrh, a little potassium permanganate was added to the drinking water. The grit that the older chicks needed they could pick up when they were let out.

OBSERVATIONS ON THE GROWTH OF CHICKS

The chicks were tagged according to their respective lots. The first weighings were made one day after the hatch, and the other weighings on the first and sixteenth day of every month. The weights could have been taken at closer intervals, but during the weighings the chicks are greatly excited, and excitement has a bad effect on the development of the chicks. Records were kept of the development of the chicks until they were two and one-half months old, after which time, they were included in the general flocks of the College.

Weights were taken when the crops of the chicks were empty. This was insured by withholding the feed until they were weighed. A Harvard balance (A. H. Thomas Co.) accurate to five milligrams was used throughout the entire experiment. As almost the same treatment was given to the chicks of both lots, the difference in their developments could only be attributed to the difference in the treatment given to the hens that produced them.

Table IX gives the weights of the chicks produced from both lots. This table shows that one-day old chicks produced from either lot differed little in their weight, the difference being in favor of the copra-meal-fed lot. At the age of about two weeks, the chicks hatched from eggs from Lot A gained more than one-half of the initial weight while those from eggs from Lot B gained only about

TABLE IX
WEIGHTS OF CHICKS

Age of chicks (approximate)	Lot A (Copra-meal-fed)				Lot B (Snail-fed)			
	No. of chicks	Total weight gm.	Ave. weight gm.	Increase gm.	No. of chicks	Total weight gm.	Ave. weight gm.	Increase gm.
One day	26	643.42	24.74		44	1063.8	24.18	
Two weeks	24	925.2	38.55	13.81	35	1140.1	32.57	8.39
Four weeks	21	1287.5	61.31	32.76	27	1170.1	43.34	10.77
Six weeks	21	1887.7	89.89	28.58	14	1082.5	77.32	33.98
Eight weeks	15	2231.9	148.79	58.90	14	1919.3	137.09	59.77
Ten weeks	9	1653.1	183.69	34.90	14	2314.8	165.34	28.25

NOTE:—The first weighings were made about one day after the hatch, and the interval between this and the second weighing varied from 9 to 16 days, but after this time, the 15-day intervals were regular.

one-third. At the fourth week, the hatching weight of the chicks from Lot A was more than doubled, but not in the case of Lot B. At the sixth week and at the eighth, the chicks of Lot B gained slightly more than those of Lot A, but the average weights of the chicks at the time were greater in Lot A. At the tenth week, the average weight of the chicks from Lot A has about twenty grams more than that from Lot B. These results show that hens fed with copra meal produce chicks that were more vigorous than those fed with snails. This difference was confined to the first four weeks of life, but the chicks of the snail-fed lot started to pick up after that time so that their rate of growth was about the same.

GENERAL OBSERVATIONS—BROODINESS

Broodiness is a maternal instinct and it occurred in the hens of both lots. Since this experiment was a test of the influence of the feeds on egg production, care was taken closely to observe any hen that became broody. A hen on becoming broody loses her appetite, stays most of the time in the nest and when approached ruffles her feathers and makes the noise characteristic of setting hens. On showing these characteristics the hen was immediately transferred to either one of the compartments of the long cement floor house or on a fattening crate. Both of these have hard floors and are well ventilated, so that the hen's inclination to sit is overcome while in these compartments.

Poultry investigators differ in their opinion regarding the treatment of the broody hen that is being "broken up" in broody coops. Kirkpatrick and Card (10) say that "when a hen becomes broody, she is shut in this coop" referring to a broody coop "with no food but with plenty of water." Kempster (11) says that broodiness "is not due to diet, and cannot be corrected by starving the bird." Lippincot (9) regards these starvation and other mistreatment sometimes recommended as not only inhuman but also a bad practice from the standpoint of production.

Egg production is an exhausting process, and therefore a hen on becoming broody, shows that in a way, she is exhausted. To bring them to laying as soon as possible, the writer therefore gave all feed and care he could to all of his broody hens, and with this treatment it was observed that the hen's desire to sit could be overcome in three days.

TABLE X—Broodiness

Hen number	Times broody	Dates broody	Dates released	Days required to break	Hen number	Times broody	Dates broody	Dates released	Days required to break
A1					B1	3	June 7'18	June 12	5
							January 12'18	January 21	2
							February 21	February 25	4
A2	4	June 13'18	June 17	4					
		October 3'18	October 7	4	B2				
		December 20	Dec'ber 23	3					
		February 22'19	February 26	4					
A3					B3	3	August 29'18	Sept'ber 2	4
							January 10'19	January 13	3
							February 21	February 25	4
A4					B4	3	November 1'18	November 5	4
							January 9'19	January 24	15
							February 18	February 21	3
A5	1	January 10'19	January 13	3	B5	1	January 14'19	January 18	4
A6	3	May 15'18	May 18	3	B6				
		January 26'19	January 29	3					
		February 26	March 1	3					
A7	1	Dec'ber 20'19	Dec'ber 27	7	B7	7	April 27'18	May 2	5
							August 13	August 17	4
							Nov'ber 12	Nov'ber 15	3
							Dec'ber 27	Dec'ber 30	3
							February 3'19	February 7	4
							February 28	March 3	4
							March 12	March 15	3
A8					B8	4	May 26'18	May 30	4
							August 29	Sept'ber 2	4
							Nov'ber 11	Nov'ber 14	3
							January 27'19	Jan. 28	1
A9	2	July 17'18	July 22	5	B9	6	April 15'18	April 19	4
		August 6	August 9	3			August 22	August 25	3
							Sept'ber 29	October 2	4
							Nov'ber 11	Nov'ber 14	3
							Dec'ber 27	Dec'ber 30	3
							January 27	January 28	1
A10					B10	4	April 16'18	April 20	4
							May 11	May 14	3
							Sept'ber 20	Sept'ber 24	4
							Nov'ber 12	Nov'ber 15	3
A11					B11	2	Nov'ber 1'18	Nov'ber 4	3
							February 18	February 21	3
A12	1	May 15'18	May 18	3	B12	3	May 31'18	June 4	4
							January 9'19	January 10	1
							February 21	February 25	4

No. of hens broody:—6
Total no. of times broody:—12
Total no. of days to break broodiness:—45
Average no. of days to break broodiness:—3.75

No. of hens broody:—10
Total no. of times broody:—36
Total no. of days to break broodiness:—36
Average no. of days to break broodiness:—3.69

Broodiness in both lots is given in Table X. This table shows that six hens became broody during the year and the rest did not. In Lot B, ten hens became broody and two did not.

Table X also gives the total number of times the hens in both lots became broody, and the total number of days required to break broodiness. The average number of days to break broodi-

ness was obtained by dividing the total number of days to break broodiness by the total number of times broody. This table shows that there is not any significant difference between Lots A and B. There were cases when it took only one day to break the broodiness of hens. There was an exceptional case of one hen requiring fifteen days to break her broodiness. The average was very similar in both lots, 3.75 days for Lot A and 3.69 days for Lot B.

MOLTING

Chickens shed their feathers once a year. This process of shedding is known as "molting", and the time and duration can be influenced by feeding. (9) In this experiment it was observed that during the molting period the egg production was reduced. This occurred during the latter part of the month of November and the earlier part of the month of December. The Superintendent of the Bureau of Agriculture Stock Farm at Alabang informed the writer that the chickens at Alabang molt during the months of July, August and the early part of September.

While growing feathers, it was observed that the birds consumed more of the protein feed than usual, the birds of the plant-protein-fed lot consumed more copra meal and those of the animal-protein-fed pen were given more snails when it was noticed that they were more anxious for them. It was during this period when the bad habit of feather pulling was practised by some of the birds of the snail-fed pen, but not by the birds of the other pen where they had access to copra meal at any time. This habit of feather pulling was corrected by increasing the daily supply of snails. This shows that the birds needed more protein to grow their feathers than to lay eggs regularly.

SIZE OF EGGS

It is well known that the feed has an influence on the quality, flavor, and color of the eggs, (9) but on the size of the eggs the authorities give no data. Observations were, therefore, made on the size of 100 eggs produced within a certain period by both lots. This was to determine whether or not the feed has any influence on the size of eggs.

The eggs were weighed in the same balance as was used in weighing the chicks. These weights were taken soon after they were collected in the afternoon. The weights were recorded, and the average for each lot determined.

Mode or class of greatest frequency:
Lot A—40; Lot B—40;
Mean:
Lot A—39.51; Lot B—39.42;
A. D. or average deviation:
Lot A—4.4802; Lot B—2.7852;
Standard deviation:
Lot A—5.51; Lot B—3.42

WEIGHTS OF THE EGGS

By reference to Table XI, the distribution of the weights of eggs may be seen. Under Column V (class value) is given the weights of the eggs in grams. 29 includes eggs weighing 28.5 grams to 29.4 grams, etc. Under Column F (frequency) the number of eggs weighed are distributed according to their weights.

It can be seen from this table that the eggs produced by Lot A varied from 29 to 56 grams in weight, while those produced by Lot B, only from 33 to 48 grams. However, the classes of greatest frequency in both lots are the same—40 grams, and the means are 39.51 grams for Lot A and 39.42 grams for Lot B, with a difference of only 0.09 grams, an insignificant figure, in favor of Lot B. But the eggs produced by Lot A were more variable than those produced by Lot B, the average deviation of each being 4.4802 for Lot A and only 2.7852

TABLE XI—Weights of Eggs

	Lot A (Copra-meal-fed)					Lot B (Snail-fed)				
V	F	FV	V—M	F (V—M)	F (V—M)²	F	FV	V—M	F (V—M)	F (V—M)²
29	1	29	10.51	10.51	110.46					
30	2	60	−9.51	19.02	180.88					
31	4	124	−8.51	34.04	289.51					
32	3	96	−7.51	22.53	169.20					
33	2	66	−6.51	13.02	84.76	2	66	−6.42	12.84	82.43.
34	9	306	−5.51	49.59	273.24	5	170	−5.42	27.10	146.88
35	4	140	−4.51	18.04	81.36	6	210	−4.42	26.52	117.22
36	8	288	−3.51	28.08	98.56	8	288	−3.42	27.36	93.57
37	7	259	−2.51	17.57	44.10	10	370	−2.42	24.20	58.56
38	6	228	-1.51	9.06	13.68	12	456	−1.42	17.04	24.20
39	5	195	−0.51	2.55	1.30	10	390	−0.42	4.20	1.76
40	15	600	0.44	7.35	3.60	13	520	−0.58	7.54	4.37
41	5	205	1.49	7.45	11.10	7	287	1.58	11.06	17.47
42	6	252	2.49	14.94	37.20	9	378	2.58	23.22	59.91
43	6	258	3.49	20.94	73.06	3	129	3.58	10.74	38.45
44	3	132	4.49	13.47	60.48	7	308	4.58	32.06	146.83
45	0	0	0	0	0	3	135	5.58	16.74	93.41
46	2	92	6.49	12.98	84.24	1	46	6.58	6.58	93.30
47	1	47	7.49	7.49	56.10	3	141	7.58	22.74	172.30
48	0	0	0	0	0	1	48	8.58	8.58	73.62
49	1	49	9.49	9.49	90.06					
50	3	150	10.49	31.47	330.12					
51	1	51	11.49	11.49	132.02					
52	1	32	12.49	12.49	156.00					
53	1	53	13.49	13.49	182.98					
54	2	108	14.49	28.98	419.92					
55	1	55	15.49	15.49	239.94					
56	1	56	16.49	16.49	271.92					
	100	3951		148.02	3495.79	100	3942		278.52	1174.35

V, class value. F, frequency. FV, frequency value. M, mean. V-M, deviation.

for Lot B. The standard deviations are very much different in both lots, being 5.91 for Lot A and 3.42 for Lot B.

MORTALITY

Mortality both among the hens and the chicks was closely observed. On noting signs of illness, the sick bird was at once isolated. Isolation had for its objects, the following:

(*a*) To prevent the spread of the disease
(*b*) To give proper treatment
(*c*) To give the sick fowl individual care
(*d*) To enable a closer observation of the progress of the disease

Among the mature stock, the first death was that of the Cantonese rooster on December 16, 1918. This rooster was very much emaciated. He suffered from bumble foot and was operated upon on December 3, 1918. From that time on, he lost his appetite. He was disinclined to move. On autopsy on December 16, the following abnormalities were found:

Deposits of mucus were found on the linings of the oesophagus, and on the upper wall of the mouth.

Small white deposits were found all over the kidneys. The rest of the internal organs were apparently normal.

Cause of death—chicken tuberculosis (?) plus the effect of operation for bumble foot.

The second death recorded was that of Hen A-9. This was on January 22, 1919. The antemortem symptoms observed were as follows:

1. A broken egg which was already rotting was found in the abdominal cavity. The contents of the egg had spread and caused the intestines to be massed together.

2. White, well defined circular spots were found sparsely scattered on the liver.

3. Kidneys enlarged and crumbly.

4. Ovaries degenerated, with one big ovum filled with a clear, thin liquid.

5. Lungs apparently normal, if anything, paler than a normal one.

The rest of the internal organs were apparently normal. Causes of death: The hen died from the poisoning effects of the rotting egg which was found in the abdominal cavity. This weakened her vitality so that the development of tuberculosis bacilli (?) which the hen probably had previously was promoted.

A third death was recorded on March 4, when Hen A-11 was found dead in a trap nest. The bird was noted to be inactive on March 3. She appeared sleepy and had lost her appetite two days previous to her death. She was emaciated.

Postmortem examination revealed the following:

1. The liver was enlarged and covered with a thin film of albuminous material.

2. The spleen was much enlarged and flabby.

3. The ovaries were degenerated and the oviduct was very small.

4. White and pasty manure was found inside the large intestines, near the opening, which was inflamed.

The other internal organs were apparently normal.

Cause of death—enteritis and dysentery.

Among the chicks, deaths were more numerous in those hatched from eggs in Lot A than in those from Lot B. Except in one or two cases, no definite symptoms were found in the postmortem examinations of the bodies of these chicks. Two or three chicks died of exhaustion due to the presence of intestinal parasites, round worms, probably *Ascaris inflexa*, and the other died of weakened vitality.

TABLE XII

MORTALITY OF CHICKS

Age of chicks	Lot A (Copra-meal-fed)			Lot B (Snail-fed)		
	No. of chicks	No. of deaths	Per cent mortality	No. of chicks	No. of deaths	Mortality
Before two weeks	26	0	0.00	44	0	0.00
Two to four weeks	26	2	7.69	44	0	0.00
Four to six weeks	24	3	12.50	30	3	10.00
Six to eight weeks	21	0	0.00	16	2	12.50
Eight to ten weeks	16	1	6.25	14	0	0.00
Ten to twelve weeks	10	0	0.00	14	0	0.00
Over twelve weeks	9	1	11.11	14	1	7.14
Total per cent of mortality			37.55			29.64

The chicks used in this experiment were not hatched at the same time, so that by the time some were ten weeks old, or over, others were only eight, six or four weeks, or less, old. If the number of dead chicks be subtracted from the number of chicks, the remainder would not necessarily tally with the original number.

Table XII gives a record of mortality of the chicks in both lots. This table shows that the greatest number of deaths among the chicks occurred at the time or before they were two weeks old. Mortality was greater among the chicks from the eggs from Lot A than among those from Lot B, showing that hens fed with copra meal produce chicks that are less vigorous than those hens fed with snails.

SUMMARY AND CONCLUSIONS

1. Six hens of Lot A (copra-meal fed) gained 794 grams in weight and four lost 464 grams in weight, with a net gain of 330 grams, and in the snail-fed lot,

Lot B, nine hens gained 1730 grams and three hens lost 200 grams, with a net gain of 1530 grams, showing that the snail-fed hens fattened more than the copra-meal-fed hens. (Table I.)

2. A native hen produced 2.197 kilograms of manure a month. There is no appreciable difference between the amounts of manure produced by the copra-meal fed lot and the snail fed lot. (Table II.)

3. Each hen in the copra-meal-fed lot consumed 6.82 kilograms mash, 15.89 kilograms grains and 1.76 kilograms copra meal, and in the snail-fed pen, each hen consumed 6.96 kilograms mash, 16.19 kilograms grains, and 91.62 kilograms snails. This shows that the copra-meal fed hens consumed the same amount of feeds other than protein as did the snail-fed chickens. Both lots had access to the mash hoppers all the time. The mash consumed in both hens is approximately two-thirds of the grain feed consumed. (Table III.)

4. The copra-meal-fed lot produced during the year 426 eggs, with an average of 36.25 eggs per hen, and the snail-fed lot produced 645 eggs with an average of 53.75 eggs per hen. This shows that the hens fed with snails produced more eggs than those fed with copra meal. (Table IV.)

5. Molting in both lots was observed during the months of November and December. A comparatively low egg production was observed during the months of August, September, October, November, December and January. (Table V.)

6. There was a loss of six pesos and forty three centavos in the operations of the copra-meal-fed lot, while there was a gain of two pesos and thirty-one centavos in the snail-fed lot over the cost of the feeds. (Table VI.)

7. Copra meal has no apparent difference in effect on the fertility of the eggs produced from snails. About eighty per cent of the eggs produced by both lots were found to be fertile. (Table VII.)

8. Hatchability was lower in the eggs produced by the snail-fed lot than in those by the copra-meal-fed lot, the figures being 43.13 and 50.00 per cent, respectively. (Table VIII.)

9. The difference between the average weights of one-day old chicks produced from the copra-meal-fed lot and those produced from the snail-fed lot is insignificant. The chicks produced from eggs from the copra-meal fed lot were more vigorous than those from the snail-fed lot up to the fourth week of life, after which time, the chicks from the snail-fed lot began to pick up, so that their rate of growth was the same. (Table IX.)

10. More hens became broody in the snail-fed lot than in the copra-meal-fed lot. Broodiness was broken after about three days. (Table X.)

11. There was no observable difference in the size of the eggs produced by both lots, the average being about thirty-nine grams. (Table XI.)

12. Mortality was greater among the chicks from the copra-meal-fed lot than among those from the snail-fed lot. These deaths were confined mostly to the first four weeks of life. (Table XII.)

13. Two hens died in the copra-meal-fed lot, while none died in the snail-fed lot.

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Photo by L. B. Uichanco

A CAPON WITH YOUNG CHICKS, COLLEGE OF AGRICULTURE

Capons as Brooders

By Francisco M. Fronda

There are hens that leave the chicks before they have grown feathers enough to warm themselves. Once left in that condition the little chicks lose their vigor and the final outcome is that they are predisposed to disease. One means of overcoming this trouble is by the use of capons—unsexed male birds. When trained, they become excellent mothers, some becoming even much better than hens themselves.

In places where chickens are raised, cockerels are always found in excess, and are more profitably caponized. If these capons are trained to take care of chicks, they can be made to pay for their keep while growing and laying on fat, for while taking care of chicks, they can at the same time grow and fatten.

Capons, unlike hens, do not make any distinction between chicks of different sizes. For this reason and because capons are usually bigger and can cover areas wider than hens, the chicks of two different settings can be allowed to go together and given to the capon. This cannot be very well done with hens, for once the hen sees chicks other than her own, she will peck or otherwise drive off the newly introduced ones. Where chicks are hatched in the incubator, capons may be used to brood them.

It has been observed that the tamest hen will leave the chicks when she begins to lay eggs. This never happens with capons, which, of course, do not lay eggs, and the chicks may be weaned after any length of time, or stay with the capon until self-weaned.

Hens which have just set are not in laying condition, and most of the time they do not get into laying condition until after the chicks that they are rearing are weaned. Therefore, the earlier the hens leave the chicks, the sooner they get into laying condition. So, if the chicks are given to capons instead, the time when hens are not laying will be very much shortened.

With these advantages, there is no apparent reason why they should not be used as brooders in place of hens. The only difficulty that one may meet is in the training.

Training a capon to become a "mother" is not difficult. It does not require any previous experience on the part of the operator to do this. What one needs in dealing with such animals is that he should have patience enough to make the capon as tame as possible. He should also have patience enough to teach the capon to sit down once in a while. This, of course, is necessary because chicks need warming even during the day time.

Some have tried to train capons to brood by confining them in a box or empty barrel lined with excelsior and then placing the chicks under them at night. But the capons would leave the chicks in the morning. A visitor to the College recommended that before confining the capon in a box or any similar material, the arm pits first be pricked with a needle. This would make the capon quiet, for the more he moved the more pain he would feel. This procedure was not tried in the College, for success was obtained by slightly modifying the first method, as follows:

The capon was confined in a box narrow enough so that he could not turn around, and low enough so that when the box was covered with wire netting or slats made of bamboo pieces or wood he could not stand, thus forcing him to remain in a setting position. He was confined in this box all day, except when fed and watered. He was then taken out. After a day or two of such training, the capon would learn to sit down at regular intervals. Then at night the chicks were placed under him. In the morning, the capon was staked. The capon soon learned to treat the chicks in much the same manner as a hen would.

The chicks were closely observed and once some were seen to be chilled, the capon was placed back in the box with the chicks under him. On the third or fourth day, the chicks were already strong and the capon could then be turned loose and depended upon to take care of the chicks.

The Growth and Egg Production of Ducks as Affected by Feeding Rice and Corn *

By Ezequiel E. Alcasid

INTRODUCTION

It is believed that all races of domesticated ducks are descended from the wild Mallard, *Anas boscas* Linnæus; in certain regions wild specimens are captured and domesticated even at the present time. The original home of *Anas boscas* has not as yet been definitely determined. The species is widely distributed over the temperate countries in the Northern Hemisphere.

The Philippine domesticated ducks are believed to be of Chinese origin, having been brought into the islands in comparatively recent times by Chinese immigrants. In some places the duck industry in this country is fairly well established. In Pateros and the neighboring localities along the Pasig River duck raising is the principal occupation of the inhabitants. On a smaller scale than in Pateros, ducks are raised in some towns of Bulacan, Laguna, Pampanga, and Pangasinan, in Luzon, and in Negros in the Visayan Islands. Existing conditions in the Philippines are favorable for duck raising in almost all respects. Water abounds in many places; feeds, in the form of grains, snails, and forage are easily procurable at a moderate cost throughout the year; and labor can be secured for this purpose at a rate much lower than for many other industrial pursuits. Duck eggs are very much in demand, and there are also good prospects of a market for the meat breeds.

There are many places in the Islands that have conditions for duck raising similar to or better than those obtaining in Pateros. We believe that it is just a question of getting the people acquainted with the simple fundamental technique of the industry in order to make duck raising a more widely pursued occupation in the Philippines.

The present work was undertaken (1) To determine the effects of different kinds of feeds (*a*) on the growth, and (*b*) on the egg-production of ducks; (2) to determine the effect of caponizing on the drake and the reaction of the caponized drake to different kinds of feeds; and (3) to find out whether it is possible to raise ducks where the water supply is so limited that they do not have a place in which to swim, and where animal food is not procurable in abundant quantities.

EXPERIMENTS ON INCUBATION

In the barrio of Uaua, Calamba, ducks are raised on a small scale, from stock of unknown origin. On January 2, 1917, a number of eggs selected from those laid by apparently well-formed two-year-old ducks were brought to the College for preliminary incubation trials. The results with this lot and with a second lot brought later are given elsewhere in this paper.

Two methods of incubation were used. First; natural incubation, using hens for the purpose. The results from this method were almost zero on account of the infestation of the nests by mites, which caused the setting birds to leave the eggs. These results are not in accord with those obtained by Filipino duck raisers, for they generally are more successful in getting good hatches with natural incubation by hens than by any other process. According to information received from duck raisers in Pateros and Mayondon, another advantage of

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natural incubation is that ducklings hatched by hens develop into more robust and earlier maturing birds.

The second method used was artificial incubation. A "Queen" incubator with a capacity for 240 chicken eggs was used. Owing to the lack of familiarity with the machine on the part of the operator, the first results were not encouraging. In later trials, as the experimenter became better acquainted with the mechanism of the incubator and the requirements in the way of proper temperature, moisture, ventilation, etc., better results were obtained.

The following table shows the results from artificial incubation:

TABLE I

RESULTS FROM ARTIFICIAL INCUBATION

	First incubation	*Second incubation*
Number of eggs placed	195	195
Number of infertile eggs	47	42
Number of dead germs	16	23
Number of eggs broken	1	0
Number of dead in shell	87	68
Number pipped	12	7
Number hatched	35	55
Per cent of infertile eggs to the total number of eggs incubated	24.10	21.53
Per cent of ducklings hatched to the total number of fertile eggs incubated	23.66	35.88

CARE OF DUCKLINGS

The ducklings hatched February 2, 1917. No feed was given for twenty-four hours.

On the second day the ducklings were tagged and fed with hard-boiled eggs moistened with water. The amount of feed was not regulated. A shallow pan of drinking water was furnished the ducklings every time they were fed.

From the third to the sixth day, the ration was hard-boiled eggs mixed with rice bran and a small quantity of grit moistened with water. The ducklings were fed six times a day.

From the seventh to the sixty-seventh day, the feed consisted of ground corn and rice with rice bran of no definite proportions, moistened with snail broth. A small quantity of finely chopped young grass was added to the feed.

At the end of sixty-seven days the ducklings were divided into separate lots. Each lot was given a different food combination as recorded in the experimental data given later in this paper.

After hatching, the ducklings were allowed to remain inside the incubator until their feathers were dry, then they were placed in a flannel-lined box covered with a flannel curtain. This cold-frame hover box was so constructed that the ducklings could go in and out during the day. At night the door was closed and they were confined in the box. Their run consisted of a small cement floor enclosed with wire netting. Once in a while the gates were opened so as to allow the ducklings to go to an adjoining grass lot. Water was furnished them at meal time and at certain other intervals during hot weather. When the birds were half or partly grown they were housed in barrels turned on their sides, as this form of shelter was found convenient.

Weekly weighing of the individuals was made to determine the relative effect of rice and corn as feeds for ducks. Table II shows the results.

EXPERIMENT I

The object of this experiment was to determine the comparative values of corn and rice as feeds for ducks, and the effects on egg production and on growth. Each lot was confined separately in a corral 7 by 10 meters with a small nipa shack at one end for shelter.

Snails were added to the meals from time to time in order to furnish animal matter in the feed. As the amount given was equal for each lot, at each time no considerable effect from this source could appear as error in the experiment.

Snails were furnished on the following dates:

From February 5, 1917 to April 5, 1917 snail-broth and from April 6, 1917 to October 30, 1917 snails.

In the snail-feeding period there were 27 days when no snails were fed. The reason for the omission on these days was that the weather was so bad and the lake so rough that no snails could be procured.

Therefore, during the course of the experiments the ducks ate snail-broth for two months and snails for five months and twenty-seven days.

Lot I, consisting of nine birds, was given a liberal amount of the following mixture: 3 parts rice meal, 2 parts rice bran and 135 grams of snails daily.

Lot II, consisting of nine birds, was given a mixture of 3 parts corn meal, 2 parts rice bran and 135 grams of snails daily.

Feed was given three times a day, i. e., in the morning, at noon and in the afternoon. After the experiment had been carried through for one month and eleven days the number of feeding was reduced to twice a day and the amount of snails increased to 200 grams daily.

It was the original intention of the writer to work only on the egg production of ducks as affected by feeding rice and corn. Later, it was found advisable to determine in this connection the effect of the feeds mentioned on the growth also. The recording of experimental results was begun when the ducklings were sixty-seven days old. Table I shows the average weekly gain in weight of the individuals to be 23.84 grams in Lot I and 23.91 grams in Lot II for thirty-two weeks, representing thus no appreciable difference.

TABLE II

AVERAGE WEEKLY WEIGHTS AND INCREASE

FIRST HATCHED DUCKS

Age in weeks	*Lot I*	*Ave. weight grams*	*Ave increase grams*	*Age in weeks*	*Lot II*	*Ave. weight grams*	*Ave. increase grams*
	No. of ducks				No. of ducks		
1	9	392.44	0	1	9	426.55	0
2	9	531.88	129.38	2	8	531.50	80.00
3	9	523.22	13.55	3	8	570.85	45.62
4	9	616.33	71.00	4	8	630.37	33.25
5	8	714.62	70.50	5	8	684.75	46.87
6	8	785.12	69.22	6	8	712.37	22.62
7	8	782.00	−3.13	7	8	765.00	6.37
8	8	720.87	63.85	8	8	818.25	99.75
9	8	818.12	28.25	9	8	847.37	25.12
10	7	889.28	1.28	10	8	858.50	14.87
11	7	1059.50	28.00	11	8	878.37	18.62
12	7	954.71	38.85	12	7	817.00	67.00
13	7	982.57	32.42	13	7	939.14	22.14
14	7	970.70	3.85	14	7	924.00	1.71
15	7	1029.00	58.50	15	7	966.28	42.28
16	7	1018.12	50.62	16	7	957.28	−9.00
17	7	1008.12	15.62	17	7	933.14	−15.57
18	7	1049.00	47.87	18	7	979.14	46.00
19	7	1019.12	−17.50	19	7	1015.85	36.71
20	7	1013.00	6.12	20	7	1035.14	19.26
21	7	1006.37	13.62	21	7	998.14	−37.28
22	7	1025.75	16.62	22	7	1046.28	33.85
23	7	989.50	−38.18	23	6	1018.00	−43.00
24	7	996.50	13.14	24	6	1036.50	18.83
25	7	1041.87	39.12	25	6	1048.50	11.66
26	7	1049.50	52.37	26	6	1036.33	−16.66
27	7	1081.57	−18.71	27	6	1017.00	−17.66
28	7	1066.87	−5.75	28	6	1034.66	14.50
29	7	1048.62	−15.50	29	6	1056.50	8.83
30	7	1017.75	−33.37	30	6	1055.16	13.00
31	7	1022.87	5.25	31	6	1069.33	15.66
32	7	1024.87	1.84	32	6	1080.00	11.15
Averages of average weekly growths			23.84				23.91

MATURITY

In the experiments the ducks were not forced to maturity. By maturity is meant, in this case, the time when the ducks laid their first egg. Table III shows the maturity of the first hatched ducks.

TABLE III

MATURITY OF DUCKS

Lot No.	No. of ducks	Average age (in days) when first egg was laid		
		Maxim.	*Minim.*	*Average*
Lot I. . .	3	195	189	191
Lot II . .	3	207	191	199

The ducks used in Experiment I were hatched February 2, 1917. They, were reared during the rainy season which is not considered favorable for normal development of ducks. The first egg in Lot I was laid August 12, 1917, at the age of 189 days, or a little over 6 months. In Lot II the first egg was laid August 14, 1917, at the age of 191 days.

According to information secured from Filipino duck raisers, ducks usually lay their first eggs after four months, if they are well cared for; but if they are not properly treated, it may be nine or ten months before they lay eggs. Graham Hope (2) states that domesticated fowls nearing maturity can be forced to lay eggs at an early age by giving them some stimulating food, like meat. This observation may equally be true with ducks. Most of Filipinos maintain their ducks. almost entirely on snails two months after hatching, and this feeding is continued throughout.

Tables IV and V give the date of egg laying and the weight of the eggs collected from individuals in each lot. These tables enable us to make the following observations:

1. Lot I fed with rice and rice bran laid their first eggs on August 12, 15 and 16, an average of about six days earlier than Lot II.

Lot II fed with corn and rice bran, laid their first eggs on August 14, 17 and 30, 1917.

2. The total number of eggs collected from Lot I was 78 and from Lot II, 39. This shows a decided advantage in favor of the lot fed rice and rice bran.

3. The average weight of eggs in Lot I is 50.50 grams, in Lot II, 52.34 grams.

4. Lot I had a longer laying period than Lot II.

TABLE IV

RECORD OF EGG PRODUCTION OF FIRST-HATCHED DUCKS

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Average
Lot I—3 ducks																																	
Aug.												1	0	1	2	3	2	2	1	0	1	1	2	2	3	3	3	1	3	2	0	33	11.00
Sept.	2	1	2	0	2	2	2	3	1	2	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	0	0	24	8.00
Oct.	0	0	0	1	0	0	2	2	1	0	0	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	11	3.66
Nov.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Dec.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	.33
Jan.	0	0	0	0	0	0	0	0	1	1	0	1	1	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	2.33
Feb.	0	0	0	0	0	0	0	0	1	1	0	0	0	0																		2	
Total																																78	.66
Lot II—3 ducks																																	
Aug.														1	1	0	1	1	1	0	0	1	0	1	0	0	1	2	2	3	0	15	5.00
Sept.	1	2	1	0	0	2	2	1	0	1	1	1	0	0	1	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0		17	5.66
Oct.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Nov.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Dec.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2	.66
Jan.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	.66
Feb.	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0							3	1.00
Total																																39	

TABLE V

EGG PRODUCTION. LOT I—FIRST-HATCHED DUCKS

A-2		*A-4*		*A-6*		*Unidentified eggs*	
Date	*Weight grams*	*Date*	*Weight grams*	*Date*	*Weight grams*	*Date*	*Weight grams*
12-VIII-17	53.80	16- VII-17	46.80	15-VIII-17	50.14	22-XII-17	50.00
14-VIII-17	47.95	23-VIII-17	48.75	16-VIII-17	47.40	9- I-18	55.00
15-VIII-17	52.25	24-VIII-17	44.00	17-VIII-17	49.25	10- I-18	50.00
16-VIII-17	48.50	25-VIII-17	47.00	18-VIII-17	50.33	12- I-18	55.00
17-VIII-17	50.25	26-VIII-17	47.90	25-VIII-17	42.57	13- I-18	54.00
18-VIII-17	49.50	27-VIII-17	44.60	26-VIII-17	48.53	14- I-18	59.50
19-VIII-17	47.10	29-VIII-17	47.72	27-VIII-17	46.70	14- I-18	57.50
21-VIII-17	53.40	30-VIII-17	42.90	28-VIII-17	46.60	17- I-18	51.50
22-VIII-17	53.70	5-IX-17	43.05	29-VIII-17	47.90	9- II-18	55.00
23-VIII-17	50.02	6-IX-17	43.75	1-IX-17	46.60	10- II-18	48.00
24-VIII-17	50.53	7-IX-17	43.75	2-IX-17	52.50		
25-VIII-17	53.93	8-IX-17	49.95	3-IX-17	49.40		
26-VIII-17	44.54	10-IX-17	50.00	5-IX-17	59.70		
27-VIII-17	42.90	7-X-17	59.57	6-IX-17	45.00		
29-VIII-17	47.53	8-X-17	54.07	8-IX-17	47.05		
30-VIII-17	44.73	9-X-17	57.20	9-IX-17	45.98		
1-IX-17	47.20	12-X-17	52.25	10-IX-17	51.90		
3-IX-17	45.40	13-X-17	52.50	24-IX-17	53.50		
7-IX-17	51.40	15-X-17	54.90	8-X-17	58.20		
8-IX-17	44.60	17-X-17	54.50				
22-IX-17	57.25						
25-IX-17	59.00						
26-IX-17	49.30						
27-IX-17	53.70						
28-IX-17	53.00			Average weight			
29-IX-17	46.80			50.50 grams.			
4-X-17	60.00						
7-X-17	60.30						
8-X-17	59.90						

LOT II—FIRST-HATCHED DUCKS

B-2		*B-4*		*B-8*		*Unidentified eggs*	
Date	*Weight grams*	*Date*	*Weight grams*	*Date*	*Weight grams*	*Date*	*Weight grams*
17-VIII-17	48.25	30-VIII-17	54.40	14-VIII-17	55.40	20-XII-17	51.50
18-VIII-17	46.66	10-IX-17	58.20	15-VIII-17	50.55	25-XII-17	51.00
19-VIII-17	45.80			22-VIII-17	45.23	16-I-18	54.50
24-VIII-17	33.80			27-VIII-17	54.30	16-I-18	57.70
28-VIII-17	51.50			28-VIII-17	51.00	9-II-18	48.70
29-VIII-17	44.50			29-VIII-17	50.90	10-II-18	52.00
30-VIII-17	44.60			30-VIII-17	49.40	14-II-18	52.50
2-IX-17	54.44			1-IX-17	52.95		
3-IX-17	49.93			2-IX-17	50.50		
6-IX-17	53.70			6-IX-17	57.70		
7-IX-17	52.20			7-IX-17	51.25		
				8-IX-17	51.09		
				11-IX-17	60.17		
				12-IX-17	51.40		
				15-IX-17	59.73		
				19-IX-17	61.00		
				20-IX-17	60.40		
				24-IX-17	58.30		
				27-IX-17	63.95		

Average weight 52.34 grams

TABLE VI
AVERAGE WEEKLY WEIGHT AND INCREASE
SECOND-HATCHED DUCKS

Age in weeks	*Lot I-a*	*Ave. weight grams*	*Ave. inc. grams*	*Age in weeks*	*Lot. II-a*	*Ave. weight grams*	*Ave. inc. grams*
	No. of Ducks				No. of Ducks		
1	22	69.09	0	1	22	66.73	0
2	22	79.86	10.64	2	21	80.14	12.71
3	22	83.77	11.90	3	21	89.43	9.85
4	22	102.60	14.45	4	21	108.85	18.61
5	21	121.31	11.40	5	21	117.38	6.38
6	20	139.05	17.05	6	20	140.42	26.32
7	19	178.36	44.05	7	20	176.74	35.74
8	19	172.43	-9.84	8	20	167.47	-5.21
9	19	172.73	12.50	9	19	193.33	26.22
10	17	226.58	41.00	10	19	216.94	25.83
11	17	240.00	13.41	11	19	221.98	2.77
12	17	273.64	28.31	12	19	250.11	33.16
Average of the average weekly growth for 1st period		17.72					17.48

Age in weeks	*Lot I-a*	*Ave. weight grams*	*Ave. inc. grams*	*Age in weeks*	*Lot II-a*	*Ave. weight grams*	*Ave. inc. grams*	*Age in weeks*	*Lot III-a*	*Ave. weight grams*	*Ave. inc. grams*
	No. of Ducks				No. of Ducks				No. of Ducks		
								12	12	264.21	0
13	11	300.59	31.09	13	12	285.75	38.25	13	12	294.33	28.2
14	11	330.81	24.00	14	12	299.66	13.92	14	12	314.93	28.2
15	11	331.10	33.00	15	11	297.18	-16.54	15	11	361.73	26.09
16	11	367.91	48.45	16	11	332.27	26.00	16	11	405.18	42.73
17	11	378.63	7.27	17	11	333.36	10.45	17	11	423.45	18.27
18	11	412.63	34.81	18	10	348.50	22.60	18	11	450.18	16.73
19	11	448.82	35.09	19	10	401.40	43.40	19	11	505.36	64.27
20	11	536.75	55.75	20	10	448.80	47.50	20	11	533.36	27.09
21	8	621.25	84.50	21	10	477.20	28.60	21	10	617.80	60.00
22	8	439.54	-2.00	22	10	471.90	-5.30	22	10	661.90	-3.30
23	8	651.35	42.25	23	10	479.60	7.70	23	10	668.10	56.20
24	8	636.75	-2.37	24	10	476.30	-3.30	24	10	641.20	26.90
25	8	709.00	92.25	25	9	542.00	50.55	25	10	694.90	57.70
26	8	719.75	8.00	26	7	506.14	7.57	26	10	727.70	29.80
27	8	733.37	12.37	27	7	514.71	8.43	27	10	745.70	20.00
28	8	737.75	4.37	28	7	515.71	1.00	28	10	755.90	10.20
29	8	743.87	6.12	29	5	538.60	-1.60	29	10	755.90	6.00
30	8	760.25	16.37	30	5	559.00	20.40	30	10	769.40	8.50
31	8	777.37	12.62	31	5	592.00	33.00	31	10	770.10	1.31
32	8	824.87	48.25	32	5	608.00	16.00	32	10	766.70	6.40
33	8	841.62	16.75	33	5	647.80	39.80	33	10	798.00	21.30
34	8	865.62	20.75	34	5	703.00	55.20	34	10	833.90	35.90
35	8	876.62	17.75	35	5	710.40	7.40	35	10	843.10	9.20
36	8	880.37	9.00	36	5	717.50	6.80	36	10	855.40	12.30
37	8	871.50	10.37	37	5	729.00	11.80	37	10	865.60	10.20
38	8	892.75	13.50	38	5	735.80	7.40	38	10	856.20	6.00
39	8	908.25	41.75	39	5	751.60	5.30	39	10	869.20	9.00
40	8	902.75	-6.75	40	5	771.00	19.40	40	10	858.51	-17.50
41	8	817.87	84.87	41	5	527.00	-44.00	41	10	838.10	-10.40
42	8	896.87	79.00	42	5	788.40	61.20	42	10	870.70	32.60
43	8	895.87	-1.00	43	5	782.50	-6.20	43	10	869.20	-1.50
44	8	862.75	-20.62	44	5	741.80	-40.40	44	10	837.80	-33.00
45	8	885.50	11.50	45	5	748.80	7.00	45	10	861.30	33.50
Ave. of the ave. weekly growth for 2nd period		26.33				14.62					19.01

EXPERIMENT II

This experiment supplements Experiment I, verifying the results found. The second-hatched ducks were used in this experiment. The separation of the lots however, for separate feeding with rice and with corn was begun when the ducklings were fourteen, instead of sixty-seven, days old. The advantage of this over the first trial was that results arrived at were more pronounced. Practically the same kinds of feeds were given as with the first-hatched ducks. Each of the lots was confined separately with a small nipa house for shelter, and each lot had a grassy plot on which they could forage at will. *

* As in the case of first-hatched ducks, snails were furnished to the different lots to supply animal matter in the feed.

Snails were given on the follwing dates:

From April 29, 1917, to June 8, 1917, snail broth, and from June 9, 1917 to October 30, 1917, snails.

As in the case of the first-hatched ducks, the second-hatched ducks also did not get snails for 27 days of the snail-feeding period.

Therefore, the ducks used in Experiment II ate snail broth for one month and nine days and snails for three months and twenty-four days during the course of the experiment.

When the ducklings reached the age of three months and seven days, another lot was made up, taking six ducklings from each of the two lots, which were fed with rice and corn, respectively. To each lot the same amount of rice bran was added. The feed given to this third lot was a combination of the feeds of Lots I-a and II-a. The object of this third lot was to determine the combined effect of rice and corn.

Weekly weighing of the individuals was made as in the first experiment, to show the effects of the three kinds of feed combination on the development of ducks.

The results are summarized in Tables VI and VII. The main steps in this experiment were as follows:

Ducklings hatched April 15, 1917. No feed given for twenty-four hours.

They were fed boiled eggs the next day. On the third day rice bran, hard boiled eggs with fine sand and chopped young grass.

At the end of two weeks the ducklings were divided into two groups and were given the following feeds:

Lot I-a,* 1 part rice meal, 2 parts rice bran, a small amount of sand and cut young grass, the whole moistened with snail broth.

Lot II-a, 1 part corn meal, 2 parts rice bran, a small amount of sand and cut young grass, the whole moistened with snail broth.

Ducklings were fed four times a day; i. e., in the morning at 7 and 10 o'clock and in the afternoon at 1 and 5 o'clock. After the experiment had gone on for a month and nine days the number of grain feedings was reduced to three times a day. At 10 o'clock each morning, 243 grams of cooked snails were given.

At the age of sixty-seven days another lot which was taken from Lot I-a and Lot II-a was made up and this was fed rice, corn and rice bran in the proportion of 1:7:2. At this time Lots I-a and II-a received respectively a 1:1 ration of rice meal and rice bran, and 1:1 corn and rice bran. Each lot was also given 1 kilogram of snails at 10 o'clock each morning.

The average weekly increase in weight of the individuals in each lot for the first twelve weeks was a follows: Lot I-a, 17.72 grams, Lot II-a, 17.48 grams, again showing no appreciable difference. The last set of the experiment started when the ducks were 3 months and seven days old. The average weekly increase of weight of the individuals in each lot was as follows: Lot I-b, 26.33 grams; Lot II-b, 14.52 grams; and Lot III-b, 19.01 grams. This later period from the thirteenth week to the forty-fifth showed greater growth in the rice-fed lot, the combination lot coming second and the corn lot third.

The egg production on this second hatching was not considered, as the ducks laid their eggs very late.

Table VIII shows the age at maturity, when first egg was laid by the ducks hatched from the second lot of eggs.

*The designations Lot I and Lot II are used for the lots in the first experiment, while Lot I-a and II-a are used to designate the corresponding lots in the second experiment, and I-b, II-b and III-b the corresponding lots used in the second part of Experiment II.

TABLE VIII

MATURITY OF DUCKS

Lot No.	No. of ducks	Age in days when first egg was laid.
I-b	8	215
II-b	2	298
III-b	4	287

These ducks were hatched April 15, 1917. Ducks in Lot I-b matured the earliest, the first egg having been laid on November 20, 1917 when the birds were 215 days old. In Lot II-b the birds laid their first egg on February 13, 1917, when the ducks were 298 days old. In Lot III-b the ducks laid their first eggs on February 2, 1917, when the ducks were 287 days old.

The figures given in Table VIII show that the ducks belonging to Lot I-b in which the feed used was a rice ration, matured earlier than any individual from Lot II-b, which was fed a corn ration, or Lot III-b, which was fed a combination of corn and rice.

MORTALITY

The ducklings were reared during rainy weather and the wet condition of the ground probably had a bad effect on the young birds. When the ducklings were a few weeks old diarrhœa broke out among them, the disease having been presumably caught from an adjoining infected lot of chickens. Mites were abundant and the presence of this pest might account to some extent for the lowered vitality of the flock. As the ducklings grew older, the rate of mortality in the different lots varied considerably. These differences may probably be due to the differences in the feed given to each lot.

TABLE IX

MORTALITY DUE TO DISEASES

Lot number	*Number of ducklings dead*		*Total*	*Number of ducklings living*	*Total number of ducks*	*Per cent of mortality*
First-hatched ducks Lot I	*Date of death*					
	May 7, 1917	1	3	6	9	33.33
	June 9, 1917	1				
	Jan. 1, 1917	1				
Lot II	Apr. 15, 1917	1				
	June 25, 1917	1	3	6	9	33.33
	Sept. 8, 1917	1				
Second-hatched ducks Lot I-a	May 28, 1917	1				
	June 2, 1917	2				
	June 26, 1917	1	5	17	22	22.73
	June 28, 1917	1				
Lot II-a	May 5, 1917	1				
	June 1, 1917	1	4	18	22	18.18
	June 2, 1917	1				
	June 20, 1917	1				
Last set of experiment Lot I-b	Sept. 6, 1917	1	3	8	11	27.27
	Sept. 8, 1917	2				
Lot II-b	July 3, 1917	1				
	Aug. 23, 1917	1				
	Oct. 13, 1917	2	7	5	12	58.33
	Oct. 23, 9117	1				
	Nov. 9, 1917	1				
	Nov. 11, 1917					
Lot III-b	Aug. 3, 1917	1	2	10	12	16.66
	Sept. 14, 1917	1				

Table IX shows that with the ducks hatched in the first incubation the per cent of mortality for both Lot I (rice ration) and Lot II (corn ration) was 33.33. With the ducks hatched in the second incubation, the per cent of mortality in Lot I-a (rice ration) was 22.73; in Lot II-a (corn ration), 18.18. This second series where Lot I-a had a higher per cent of mortality than II-a was conducted for twelve weeks, for, as stated above, after three months and seven days another lot was made from individuals taken from Lot I-a and Lot II-a to form Lot III-b.*

Lot III-b had the lowest per cent of mortality, 16.16, and Lot II-b (corn ration) had the highest, 58.33.

COLOR AND FLAVOR OF EGGS

Observations were made comparing the color and taste of eggs from ducks reared on land and those reared on water. The observations were also made with respect to the kind of feeds given to ducks. The different kinds of feed used were as follows: Snail alone, copra cake with a small amount of snails, and grain with a small amount of snails. The eggs gotten as a result of each condition of treatment as to feeding and rearing, were cooked in two ways: boiled hard and fried.

Results:

Color of egg yolks: *rice ration*,—yolk light yellow both when fried and boiled; *corn ration*—yolk, deep orange when fried and light orange when boiled; *reared dry and fed with snails, reared on water and fed with copra cake, and reared on water and fed with snails*—yolk, light yellow both when fried and boiled.

Taste:

Lots I and I-b (rice ration)—putrid. Lots II and II-b (corn ration)—normal. The putrid taste of eggs from ducks fed with rice ration was probably due to the fact that old, stored grains were used. These sometimes had an odor of naphthalene, as this substance was spread among the grains to protect against insect pests while in storage.

FERTILITY TESTS

Eggs produced under the following conditions were tested as to relative percentage of fertily: (1) Ducks reared dry; (2) ducks raised on water; (3) ducks fed with snails; (4) ducks fed with grain and a small amount of snails (5) ducks fed with copra cake and a small amount of snails.

The object of testing for the percentage of fertility was to find out whether feed and the method of rearing had any effect on the fertility of the eggs. Also, to see which method of rearing and which combination of feeds would produce eggs which on account of the resulting high percentage of fertility can be used at a profit for the making of *balot*.†

The test for the fertility of eggs was not conclusive, for the eggs used were only six in Lot I and four in Lot II, and two of the eggs in Lot II were old. At the time when this test was made the ducks were not laying regularly.

The number of drakes in each lot was 4 and the females were only 3.

Thirty eggs were purchased from Pulong Calamba, which were laid by one-year-old ducks. The number of females in the flock was 300; of drakes, 40. The feeds were copra cake and some snails.

Another lot of 30 eggs was purchased in Mayondon. These eggs were laid by ducks about eight months old. There were 40 females and 5 drakes in the flock. Their only feed was snail. These ducks were reared on water.

Another lot of 29 eggs was bought in Mayondon. These eggs were laid by

*Lots I-b and II-b represent the remaining stock from Lots I-a and II-a, after the individual used to form Lot III-b had been separated.

†*Balot*—local name for eggs with partly developed embryo, after several days of incubation. This finds a ready market here when boiled.

ducks about eight months old. Number of females, 27; drakes, 4. Feed consisted of snails only. These ducks were reared dry.

Table X shows the results.

TABLE X

FERTILITY TESTS

Ducks reared dry		*Ducks reared on water*		*Ducks reared on water*	
Feed:-snail		*Feed:-snails*		*Feed: copra cake with small amount of snail*	
Age: 8 mo. 29 eggs		Age: 8 mo. 30 eggs		Age: 1 yr. 30 eggs	
No. of infertile	% of infertile	No. of infertile	% of infertile	No. of infertile	% of infertile
4	13.79	2	6.66	1	3.33

From the above results it may be seen that eggs laid by ducks reared dry had a greater per cent of infertility than eggs laid by ducks reared on water. This was probably due to the fact that on the water the ducks could mate better. According to the writer's observation in the barrios in the vicinity of Los Baños, ducks reared on water very seldom mated on land but on the water. Of the 29 eggs laid by ducks raised dry, 13.19 per cent were infertile; and of the 30 eggs laid by ducks reared on water, only 6.66 per cent were infertile, a difference of 7.19 per cent in favor of the latter. In another test of another lot of 30 eggs which were laid by ducks reared on water 3.33 per cent were infertile.

CAPONIZING

Caponizing, or removing the testicles from the drakes, was experimented with to some extent.

The ducklings were allowed to grow until they began to seek the female; then they were caponized.

The method is about the same as that employed with cockerels. This consists in making an incision into the sides of the body, between the last two ribs, and removing the testes. After the operation the birds were restored to their original yards and treated in the same manner as uncaponized birds.

Observations:

There was no very perceptible change of feathering. The color of the feathers was changed from light black to light reddish blue. The writer did not see the caponized birds breed. The weights increased or decreased as with the uncaponized drakes. Tables XI shows the weekly weight of the caponized drakes. Two of the drakes were caponized May 8, 1917, from the first-hatched ducks, and two from the second-hatched ducks were caponized October 20, 1917.

TABLE XI

WEEKLY WEIGHT AND INCREASE OF CAPONIZED DRAKES

First-hatched Ducks
Ration: Corn and rice bran with a little snail.

Number:	C—1		C—2	
Date	Weight grams	Increase.	Weight grams	Increase
16-V-17	850	–0	917	0
23-V-17	800	–50	863	–54
30-V-17	871	–29	955	92
6-VI-17	831	–40	1064	109
13-VI-17	762	–69	946	–118
20-VI-17	882	120	1013	67
27-VI-17	857	–25	1013	0
4-VII-17	817	–40	931	–82
11-VII-17	936	119	1009	78
18-VIII-17	875	–61	940	69
25-VII-17	794	–81	915	–25
1-VIII-17	887	93	947	32
8-VIII-17	1000	113	1057	110
15-VIII-17	894	–106	984	–73
22-VIII-17	927	33	1002	18
29-VIII-17	960	33	1020	18
5-IX-17	988	28	1077	57
12-IX-17	952	–36	1035	–42
19-IX-17	927	–25	1002	–33
26-IX-17	927	0	993	–9
3-X-17	897	–30	967	–26
10-X-17	867	70	973	6
17-X-17	963	–4	994	21
24-X-17	950	–13	965	–29
31-X-17	891	–59	955	–10
7-XI-17	880	–11	969	14
14-XI-17	893	13	973	4
Average	895.44	–2.19	977.00	2.15

Second-hatched Ducks
Ration: Rice, corn and rice bran with a little snail.

Number	B—9		B—11	
Date	Weight grams	Increase	Weight grams	Increase
28-X-17	951	0	780	0
4-XI-17	941	10	780	0
11-XI-17	951	10	790	10
18-XI-17	976	25	833	43
25-XI-17	866	−110	853	20
2-XII-17	841	−25	882	29
9-XII-17	891	50	901	19
16-XII-17	971	−20	975	74
23-XII-17	962	−9	982	7
30-XII-17	973	11	986	4
6-I-18	973	0	987	1
13-I-18	978	5	991	4
20-I-18	956	−22	986	−5
27-I-18	915	—41	934	−52
3-II-18	880	−35	853	−81
10-II-18	942	62	870	17
17-II-18	943	1	863	−7
24-II-18	891	−52	810	−53
3-III-18	873	−18	825	15
Average	930.21	− 9.88	888.47	2.5

SANITATION AND METHOD OF CONTROL OF DISEASES

In any branch of poultry raising, sanitation should receive first consideration. In the Philippines, where practically nothing in the way of sanitation is practiced in the poultry yard, the spread of contagious diseases is so quick that almost all the birds get infected in a short time.

The ducklings which were used in the present experiment were reared during the rainy season, under conditions which probably were not beneficial to their proper development. Diarrhœa broke out. The affected birds were at once isolated from the flock and their quarters disinfected with a 5% creolin solution. The disease was more prevalent when the ducklings were at the age of from one to three weeks. About 0.5 grams of magnesium sulphate in combination with a mash of rice bran and ground corn or rice was given to the sick birds. Another method of administering this remedy was by dissolving 0.5 grams of magnesium sulphate in a little water and pouring the liquid down the throats of the birds. The sick bird was given a very fine mixture of corn or rice with rice bran and a small quantity of hard-boiled eggs.

Once in a while the whole flock was given some purgative, and if there was a diarrhœa epidemic, a few crystals of potassium permanganate were dissolved in their drinking water. This was found to give good results.

Another trouble arose from an infestation of the ducklings by mites. This was remedied by applying vaseline on the space between the eyes and the bill and under the wings.

As the ducklings became older an unknown disease broke out, undoubtedly caused by the manner of feeding. The symptons of the disease were as follows: Loss of appetite, extraordinary craving for water, and lameness. A post-mortem examination showed that there was an accumulation of blood in the abdominal region, the lungs were congested, the liver was light colored and the kidneys were abnormally soft and very large in proportion to the size of the bird. The sick birds were isolated and were given some purgative. The affected birds were given a very light food of rice bran and finely ground corn or rice.

SUMMARY

The records as given above show that the ducks fed with rice and rice bran matured earlier than those fed with corn and rice bran.

The average weekly growth of the ducks fed with rice and rice bran was comparatively greater than that of the ducks fed with corn and rice bran, or than that of ducks fed with a mixture of rice, corn and rice bran.

Rice and rice bran and corn and rice bran had a marked effect on the color and flavor of eggs. Those fed with rice and rice bran laid eggs which were light yellow; and those fed with corn and rice

bran laid eggs which were deep orange when fried and light yellow when boiled.

The taste of the eggs which were laid by ducks fed with corn and rice bran was normal: while the eggs which were laid by those fed with rice and rice bran were somewhat putrid either when fried or boiled.

The shell of the eggs laid by ducks which were fed with rice and rice bran was greenish while those of the eggs laid by ducks which were fed with corn and rice bran were almost all white.

Corn and rice bran gave the highest per cent of mortality, as compared with other relations.

Ducks which were reared on the water gave a higher per cent of fertility of the eggs than those which were reared on land. For this reason, eggs which are to be used for making *balot* should be taken from ducks reared on water.

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ACKNOWLEDGEMENT

The writer expresses his obligations to Associate Professor Bienvenido M. Gonzalez for his valuable criticisms and suggestions during the course of this work.

COLLEGE AND ALUMNI NOTES

According to the annual report of the Director of Agriculture for 1918, the Secretary of Agriculture and Natural Resources "authorized and ordered in April, 1918, payment of an entrance salary of ₱1,200". The former entrance salary of graduates of this College was sometimes as low as ₱60 a month, which placed them "in the class of apprentice clerks with no higher academic training than that given in a high school and oftentimes in an intermediate school," and which served "to greatly discourage promising young men from taking a course in agriculture or to enter Government service after graduation." This later measure was adopted in due justice to college graduates.

The seniors of this College who enlisted in the Philippine National Guard were given credit for the time they stayed in the training camp and allowed to graduate, provided their records provious to enlistment and subsequent work were satifactory.

The 1919 Class of the College of Agriculture is composed of the following:

Master of Science:

Francisco O. Santos, A. B. Home address: Malolos, Bulacan. Thesis: A Study of Nitrogen Partition in Copra Meal.

Bachelors of Science in Agriculture:

1. Antonio R. Chanco. Caloocan, Rizal. Effect of Crop Rotation on Corn Production.

2. Ramon K. Habaluyas. Jaen, Nueva Ecija. Multiplication of Some Selected Strains of Upland Rices.

3. Tranquilino D. Ventura. Ilagan, Isabela. Chemical Changes during the Growth and Ripening of Banana Fruits.

Bachelors of Agriculture:

1. Felipe T. Adriano. Malolos, Bulacan. A Volumetric Method for the Determination of Lactose by Alkaline Potassium Permanganate.

2. Ezequiel E. Alcasid. Calamba, Laguna. The Growth and Egg Production of Ducks as Affected by Feeding Rice and Corn.

3. Juan B. Cabanos. San Nicolas, Ilocos Norte. Élite Multiplication and Commercial Production of Iloco Rices.

4. Esteban Collado. Ballesteros, Cagayan. A Study of the Plan of Nutrition of Students and People Living near the College Campus.

5. Pedro A. David. San Fernando, Pampanga. The Tobacco Seed Bed.

6. Leoncio Dario. Claveria, Cagayan. A Study of Physical Characters of Ilocano Rices.

7. José Esguerra. Tanay, Rizal. Mixed Planting of Corn and Rice.

8. Juan Esguerra. Aliaga, Nueva Ecija. Nursery Methods with Cacao.

9. Francisco M. Fronda. Aliaga, Nueva Ecija. A Study of the Effects of Animal and Plant Proteins in Rations for Laying Hens.

10. Joaquin J. Gonzalez. Apalit, Pampanga. The Nicotine Content of Tobacco.

11. Nemesio M. Hernandez. Paombong, Bulacan. The Effects of Natural Fertilizers on the Production of Tobacco.

12. Tomas Harder. La Paz, Iloilo. Selection of Standard Iloilo Rices.

13. Vicente F. Hidalgo. Naga, Ambos Camarines. An Economic Study of Abaca Production in Ambos Camarines.

14. Francisco P. Lago. Guinayanga, Tayabas. Feeding Experiments on Draft Cattle.

15. Benedicto C. Leaño. Malabon, Cavite. The Possibilities of Chewing Tobacco and Blended Cigarettes in the Philippines.

16. Anastasio Lipayon. Tanauan, Leyte. An Economic Study of Abaca in Leyte.

17. Gaspar Lindayag. Paombong, Bulacan. A Comparative Study of the Native and Cantonese Chickens.

18. Melecio M. Manio. San Isidro, Nueva Ecija. A Study of Physical Characters of Nueva Ecija Rices.

19. Tiburcio B. Narabal. Burgos, Pangasinan. A Study of the Economic Value of Psophocarpus tetragonolobus.

20. Teofilo A. Nisce. Balauan, La Union. Acclimatization of Foreign and Philippine Varieties of Corn.

21. José Noguera. Cavite, Cavite. The Hog Industry in the Philippines with Special Attention to the Provinces around Manila.

22. Felipe Padolina. Peñaranda, Nueva Ecija. Betel Leaf in the Philippines.

23. Fernando de Peralta. Claveria, Cagayan. A Study of the Relation of Climatic Conditions to the Vegetative Growth and Seed Production of Rice.

24. Francisco Red. Oas, Albay. Economic Study of Farm Legumes.

25. Emiliano Roldan. Baliuag, Bulacan. Black Rot of Cacao.

26. Raymundo Sabado. Naguilian, La Union. Study of Sweet Corn.

27. Felicisimo Serrano. Taal, Batangas. Making of "Nata de Piña."

28. Victor Sulit. Santa Cruz, Laguna. A Study of the Mineral Fertilizing Constituents of the Banana Plant.

29. Juan P. Torres. Santo Tomas, Batangas. Physical Characters of Batangas Rices.

30. Deogracias B. Villadolid. Nasugbu, Batangas. Sucrose Content of Foreign Varieties of Sugar Cane Growing on the College Grounds.

31. German Yap. Jagua, Bohol. A Study of the Photosynthesis of Sugar Cane.

By a vote of the Board of Regents, the College of Veterinary Science will be transferred to Los Baños at the opening of the College year.

A Cleveland tractor has recently been purchased by the College of Agriculture. The machine has been found efficient and is being utilized in pulling large plows, harrows and road scrapers, and also in connection with the operation of a small saw mill.

The construction of the new Entomology and Plant Pathology Laboratory Building is now in full swing, and this will probably be ready for occupation soon after the opening of the College year.

Dr. Manuel L. Roxas, associate professor of chemistry and secretary of the College of Agriculture, has been obliged to take a prolonged leave of absence on account of illness.

Mr. Anastasio L. Teodoro, '18, is now a student in Leland Stanford Jr. University where he is taking a course in mechanical engineering.

Mr. Otto A. Reinking, associate professor of plant pathology of this College, has been sent to China under the auspices of the United States Department of Agriculture in connection with investigation of plant diseases.

An official communication recently received at this College from the authorities of the Dominican Republic states that there is a demand in that country for capable Filipino agricultural graduates to serve in various technical positions as members of the faculty of the college of agriculture that is being organized there.

Dr. Forman T. McLean, associate professor of plant physiology of this College has been granted leave of absence till the beginning of the next College year with permission to visit China and Japan.

Professor Benvenido M. Gonzalez has been authorized to make a trip to the southern islands for the purpose of making investigations as to livestock conditions in the Department of Mindano and Sulu.

Weather Observations for February 1919.

OBSERVER—R. P. ESTIOKO

Date	Rainfall in mm. Daily	Rainfall in mm. Weekly	Temperature in °C Max.	Temperature in °C Min.	Temperature in °C Mean Daily	Temperature in °C Mean Weekly	Wind in Miles Daily	Wind in Miles Weekly	Cloudiness	Atmometer Evaporation Daily	Atmometer Evaporation Weekly	Reading in cc. Insolation Daily	Reading in cc. Insolation Weekly
Feb.													
1	0		29.0	21.1	25.0	25.2	27.3		½ cloudy	26.6		20.7	
2	0		28.0	21.6	24.8		34.0		½ cloudy	25.5		16.3	
3	0		28.5	21.4	24.9		61.8		clear	39.8		21.0	
4	0		28.0	19.6	23.8		54.1		clear	34.9		19.1	
5	4.1		25.5	21.1	23.5		96.3		cloudy	18.9		7.2	
6	10.5		25.2	20.8	23.0		105.2		cloudy	13.4		7.6	
7	2.7		26.0	21.4	23.8		77.4		cloudy	13.8		11.0	
8	0	17.3	27.0	21.1	24.0	23.9	46.3	547.1	¾ cloudy	17.3	163.6	16.3	98.5
9	0		28.5	21.4	25.0		78.4		clear	33.3		22.6	
10	0		27.5	20.1	23.8		70.7		¼ cloudy	32.1		23.1	
11	0		28.5	21.8	25.0		70.7		¼ cloudy	41.1		14.2	
12	0		27.0	21.8	24.3		35.5		¾ cloudy	24.8		11.2	
13	0		28.2	22.2	25.3		47.4		clear	29.2		13.0	
14	0		29.8	22.1	25.9		77.3		clear	36.2		16.6	
15	0	0	28.5	21.8	25.0	24.9	48.3	446.3	¼ cloudy	34.2	230.9	16.6	117.3
16	0		29.5	21.2	25.4		59.2		½ cloudy	27.7		15.2	
17	0		29.2	21.4	25.4		33.0		½ cloudy	30.9		14.6	
18	0		27.8	21.1	24.4		51.3		¼ cloudy	27.5		12.5	
19	3.5		27.0	21.6	24.3		37.9		½ cloudy	21.9		11.1	
20	0		29.2	21.8	25.4		38.3		¾ cloudy	25.1		14.4	
21	0		31.0	21.6	26.3		28.9		clear	29.0		15.1	
22	0	3.5	30.5	21.1	25.8	25.3	45.2	293.8	clear	33.8	195.9	17.6	100.5
23	0		30.5	22.1	26.3		32.6		clear	33.7		14.3	
24	0		30.5	21.6	26.0		47.9		clear	37.7		14.1	
25	T		28.0	21.6	24.8		65.2		½ cloudy	24.3		16.3	
26	0		26.0	21.6	23.8		98.4		cloudy	27.4		10.5	
27	0		29.5	22.1	25.8		89.5		clear	39.5		14.3	
28	0		30.0	21.6	25.8	25.4	67.9		¼ cloudy	30.1		20.9	
March		20.8				24.9		1644.0			809.7		337.4
1	0	T	29.5	19.6	24.5	25.3	74.1	475.6	clear	34.4	277.1	17.6	108.0

COLLEGE COFFEE PLANTATION.

Date	Rainfall Weekly	Max.	Min.	Mean Weekly
Feb. 3 to Feb. 9	37.1	28.6	7.5	23.0
Feb. 10 to Feb. 16	3.8	29.1	17.8	23.5
Feb. 17 to Feb. 23	T	29.5	18.0	23.7
Feb. 24 to Mar. 2	0	30.2	18.8	25.0

SUMMIT OF MT. MAQUILING.

Feb. 3 to Feb. 9	23.1	17.9	16.4	17.2
Feb. 10 to Feb. 16	4.8	18.1	16.3	17.2
Feb. 17 to Feb. 23	3.4	20.7	17.3	19.0
Feb. 23 to Mar. 2	3.0	18.3	16.0	17.1

450-METER ELEVATION, MT. MAQUILING.

Feb. 3 to Feb. 9	36.0
Feb. 10 to Feb. 16	4.1
Feb. 17 to Feb. 23	0.2
Feb. 24 to Mar 2	0

The weather continued dry during February with moderate winds and high evaporation but the sunshine during the month was only about half that of January, as indicated by the insolation.

FORMAN T. MCLEAN
Associate Professor of Plant Physiology.

UNIVERSITY OF THE PHILIPPINES

COLLEGE OF AGRICULTURE

LOS BAÑOS

The College of Agriculture is in its ninth year with a student body of 436. It occupies a tract of about one hundred and twenty-seven hectares on which every important crop in the Philippines is under cultivation. It has a large series of varieties of leading crops and very numerous introduced plants under tests and observation. The number of distinct cultures, not including series of fertilizer experiments, is more than two thousand. The College has fourteen concrete buildings and two of mixed materials.

The courses are:

A six-year course (the first two years' work being preparatory only) based on graduation with good grades from the intermediate schools of the Philippine Islands and leading to the degree of Bachelor of Agriculture.

A four-year course based on the completion of the public high school course, and leading to the degree of Bachelor of Science in Agriculture.

Graduate work leading to the degree of Master of Science is given to persons holding the degree of Bachelor of Science.

Tuition for non-residents of the Philippines is ₱150.00 a year.

The College year will begin June 9, 1919.

For further information address the Dean of the College.